Quarterly test #2

1. it does not form an ideal solution ✓

2. I expect the solubility to decrease ✓

3. • The solute-solute attractions are greater than the solute-solvent attractions. ✓
   • The Siga of ΔS is positive ✓

4. you will see the laser beam when it goes through the Colloid. ✓

5. $\left(\frac{0.750 \text{ moles of } CaCl_2}{1}\right)\left(\frac{111.1 \text{ g } CaCl_2}{1 \text{ mole of } CaCl_2}\right) = 83.3 \text{ g of } CaCl_2$

total mass $= 83.3 \text{ g} + 1.0 \times 10^3 = 1.08 \times 10^3 \text{ g}$ ✓

$\left(\frac{1.08 \times 10^3 \text{ g}}{1}\right)\left(\frac{1 \text{ mL}}{1.15 \text{ g}}\right) = 939 \text{ mL} = 0.939 \text{ L}$ ✓

$\text{molarity} = \frac{0.750 \text{ moles of } Mg(OH)_2}{0.939 \text{ L}} = \boxed{0.799 \text{ M}}$ ✓

6. The Triple Point temperature will decrease ✓

7. $\left(\frac{1.00 \times 10^3 \text{ g of water}}{1}\right)\left(\frac{1 \text{ mole of water}}{18.0 \text{ g of water}}\right) = 55.6 \text{ moles of water}$ ✓

$\text{mole fraction} = \frac{1.50 \text{ moles of NaCl}}{55.6 \text{ mole of water} + 1.50 \text{ moles of NaCl}}$

$= 0.0263$ ✓

45/45 100%

8.
- The equilibrium constant is extremely big. ✓
- Not an equilibrium but a complete reaction ✓

9. $MgCl_2$ will be more soluble in MnF_2 ✓

10.
$$\Delta G = -(R)(T)(\ln(K))$$
$$= -(8.314)(298)(\ln(12.1))$$
$$= -6.18 \times 10^3 \text{ J/moles}$$ ✓

11.
$$Ca_3(PO_4)_2(s) \rightleftharpoons 3Ca^{2+}(aq) + 2PO_4^{3-}(aq)$$ ✓
$$1.0 \times 10^{-25} = (3x)^3(2x)^2$$
$$1.0 \times 10^{-25} = 27x^3(4x^2)$$
$$\frac{1.0 \times 10^{-25}}{108} = \frac{108x^5}{108} \qquad \sqrt[5]{x^5} = \sqrt[5]{9.26 \times 10^{-28}}$$
$$x = 3.9 \times 10^{-6}$$ ✓
$$3(3.9 \times 10^{-6}) = 1.2 \times 10^{-5} M$$ ✓

12. $CaSO_4(s) \rightleftharpoons Ca^{2+}(aq) + SO_4^{2-}(aq)$
$$Ksp = x(0.75)$$
$$2.4 \times 10^{-5} = x(0.75)$$
$$\frac{2.4 \times 10^{-5}}{0.75} = \frac{0.75x}{0.75}$$ ✓
$$x = 3.2 \times 10^{-5} = [Ca^{2+}]$$ ✓

13. $MgF_2(s) \rightleftharpoons (aq) + 2F^-(aq)$

$K_{sp} = [Mg^{2+}][F^-]^2$

$[Mg^{2+}] = 0.0075\ M$ ✓

$[F^-] = 0.00050\ M$ ✓

$K_{sp} = (0.0075)(0.00050)^2 = 1.9 \times 10^{-9}$ ✓

A precipate will not form ✓

14. $\underbrace{SO_4^{2-}}_{\text{Base}} + \underbrace{HBr}_{\text{Acid}} \rightarrow \underbrace{HSO_4^-}_{\text{conjugate Acid}} + \underbrace{Br^-}_{\text{Conjugate Base}}$ ✓

15. $HCl + H_2O \rightarrow H_3O^+ + Cl^-$

$\left(\frac{0.140\ \text{moles of HCl}}{1\ \text{liter}}\right)\left(\frac{1\ \text{mole of } H_3O^+}{1\ \text{mole of HCl}}\right) = 0.140\ M \text{ of } H_3O^+$

$pH = -\log(0.140)$

$pH = 0.854$ ✓

16. The base is NH_3 and the Acid is Ag^+ ✓

17. $H_2CO_3 + H_2O \rightleftharpoons H_3O^+ + HCO_3^-$

K_a of $H_2CO_3 = 4.3 \times 10^{-7}$

K_a of $HCO_3^- = 7 \times 10^{-11}$

$1.5 \cdot 4.3 \times 10^{-7} = \frac{x^2}{1.5} \cdot 1.5$ ✓

$\sqrt{6.45 \times 10^{-7}} = \sqrt{x^2}$

$x = 8.0 \times 10^{-4}$ ✓

$pH = -\log(8.0 \times 10^{-4}) = 3.10$ ✓

18. $HNO_3 + HCO_3^- \rightarrow H_2CO_3 + NO_3^-$ ✓

19. $H_2SO_4 + NaOH \rightarrow H_2O + Na^+ + HSO_4^-$

New Reaction $HSO_4^- + NaOH \rightarrow H_2O + Na^+ + SO_4^{2-}$

Final $HSO_4^-(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + SO_4^{2-}(aq)$

K_a of $HSO_4^- = 0.012$

$$(0.35 - x)0.012 = \frac{x(0.70 + x)}{(0.35 - x)} \cdot 0.35 - x$$ ✓

$$-0.012x + 0.0042 = 0.70x + x^2$$

$$+0.012x \quad -0.0042 \quad +0.012x \quad -0.0042$$

$$0 = x^2 + 0.712x - 0.0042$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-0.712 \pm \sqrt{(0.712)^2 - 4(1)(-0.0042)}}{2}$$

$$= \frac{-0.712 \pm \sqrt{0.507 + 0.0168}}{2} = \frac{-0.712 \pm \sqrt{0.5237744}}{2}$$

$$= \frac{-0.712 \pm 0.724}{2} = 0.012 \text{ or } -1.44$$

$$pH = -\log(0.012) = \boxed{1.9}$$ ✓

20. b. A mixture of H_2CO_3 and $NaHCO_3$ will make a buffer ✓

21. a) $HNO_3 + HS^- \rightarrow H_2S + NO_3^-$ ✓

b) $KOH + H_2S \rightarrow HS^- + K^+ + H_2O$ ✓

22. $Ba(OH)_2$ will be more soluble in pH = 2 solution ✓

23. $\left(\frac{25.0 \text{ g of } H_2S}{1}\right)\left(\frac{1 \text{ mole of } H_2S}{34.1 \text{ g of } H_2S}\right) = 0.733 \text{ moles of } H_2S$

$\frac{0.733 \text{ moles of } H_2S}{0.1000 \text{ L}} = 7.33 \text{ M of } H_2S$ ✓

$\left(\frac{25.0 \text{ g of } KHS}{1}\right)\left(\frac{1 \text{ mole of } KHS}{72.2 \text{ g of } KHS}\right) = 0.346 \text{ moles of } KHS$

$\frac{0.346 \text{ moles of } KHS}{0.1000 \text{ L}} = 3.46 \text{ M of } KHS$ ✓

$pH = 7 + \log\left(\frac{3.46}{7.33}\right) = 7 - 0.36 = 6.67$ ✓

24. $KOH + H_2S \rightarrow HS^- + K^+ + H_2O$ ✓

$\left(\frac{5.0 \text{ g of } KOH}{1}\right)\left(\frac{1 \text{ mole of } KOH}{56.1 \text{ g of } KOH}\right) = 0.089 \text{ moles of } KOH$ ✓ ✓

$pH = 7 + \log\left(\frac{4.35}{6.44}\right) = 7 - 0.170 = 6.83$ ✓

25. $x(g) + 2y(g) \leftrightharpoons 2z(g) + 3A(g)$ ✓

$K_P = 0.57$

$0.57 = \frac{(2x)^2(3x)^3}{1.0(1.0)^2}$ ✓

$0.57 = \frac{108x^5}{1}$

$\frac{0.57}{108} = \frac{108x^5}{108}$

$0.00528 = x^5$

$x = 0.35$

$$0.57 = \frac{108x^5}{(1.0-0.35)(1.0-2(0.35))^2}$$

$$0.57 = \frac{108x^5}{065(0.09)}$$

$$0.57 = \frac{108x^5}{0.0585}$$

$$0.033345 : \frac{108x^5}{108} \quad \text{to } 8$$

$$\sqrt[5]{3.09\times10^{-4}} = \sqrt[5]{x^5}$$

$$x = 0.20$$

$$0.57 = \frac{108x^5}{(1-0.20)(1-2(0.20))^2}$$

$$0.57 = \frac{108x^5}{0.8(0.36)}$$

$$0.57 = \frac{108x^5}{0.288}$$

$$0.16416 = 108x^5$$

$$0.00152 = x^5$$

$$x = 0.27$$

$$0.57 = \frac{108x^5}{(1-0.27)(1-2(0.27))^2}$$

$$0.57 = \frac{108x^5}{0.73(0.2116)}$$

$$0.57 = \frac{108x^5}{0.154468}$$

$$0.088091676 = 108x^5$$

$$x = 0.24$$

$$0.57 = \frac{108x^5}{(1-0.24)(1-2(0.24))^2}$$

$$0.57 = \frac{108x^5}{0.76(0.2704)}$$

$$0.57 = \frac{108x^5}{0.205504}$$

$$x = 0.26$$

$$0.57 = \frac{108x^5}{(1-0.26)(1-2(0.26))^2}$$

$$0.57 = \frac{108x^5}{0.74(0.2304)}$$

$$0.57 = \frac{108x^5}{0.170496}$$

$$x = 0.25 \checkmark$$

$$0.57 = \frac{108x^5}{(1-0.25)(1-2(0.25))^2}$$

$$0.57 = \frac{108x^5}{0.75(0.25)}$$

$$0.57 = \frac{108x^5}{0.1875}$$

$$x = 0.25 \checkmark$$

$X = 0.25$ $\quad z = 2x$

$z = 2(0.25) = 0.50$ atm ✓